LEAK DETECTION AND REPAIR PROTOCOL

Per Wyoming Air Quality Standards and Regulations, Chapter 8, Section 6, *"Upper Green River Basin permit by rule for existing sources." and 40 CFR 60 NSPS Subpart OOOOa*

Andeavor Logistics

Upper Green River Basin Facilities and OOOOa Subject Facilities

June 2018

Facility Fugitive Emission Monitoring Overview

Andeavor Logistics (Andeavor) has committed to monitoring and fixing leaks at their PAD, single-well oil and gas production facilities, and compressor stations in the Upper Green River Basin (UGRB) and for other statewide NSPS OOOOa subject facilities through the implementation of a formal Leak Detection and Repair (LDAR) Program, as outlined in this protocol. Andeavor's LDAR protocol demonstrates and documents the effectiveness of efforts to minimize fugitive emissions from equipment leaks. The protocol has been developed and implemented per the Wyoming Air Quality Standards and Regulations (WAQSR), Chapter 8, Section 6 "*Upper Green River Basin permit by rule for existing sources*" (Ch. 8, Sec 6) requirements. This plan has also been developed to comply with the requirements of 40 Code of Federal Regulations (CFR) Part 60, Subpart OOOOa *"Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources"* (OOOOa). Though not all of Andeavor's facilities subject to the Ch. 8, Sec 6 LDAR requirements will be subject to the more stringent requirements of OOOOa, Andeavor Logistics is electing to operate all Ch. 8, Sec 6 LDAR-applicable sites according to OOOOa.

Per Ch.8, Sec 6, Andeavor utilized the emission factors defined in Table 2-4 of the 1995 EPA Protocol for Equipment Leak Emission Estimates (Document EPA-453/R-95-017) to calculate the uncontrolled actual fugitive emissions to determine facility LDAR applicability per Ch. 8, Sec 6. Using these estimates, the Andeavor LDAR Program will be implemented at the following facilities located in the UGRB:

- Pinedale Complex: Operating Permit 3-1-218, Construction Permit P00019707
- Mesa 14-16 Central Gathering Facility (CGF): Construction Permit MD-1425
- Mesa 15-6 CGF: Construction Permit MD-1424
- Stewart Point 16-18 CGF: Construction Permit CT-4062A

In addition, the following sites will be subject to OOOOa:

- **Well Sites:**
  - Kinney Unit 13-1 Well Site: Construction Permit P0022497
  - Trail Unit 68 Pad: Construction Permit P0023098, pending new permit TBD
  - Trail Unit 54 Pad: Construction Permit TBD
  - Trail Unit 155 Well Site: Construction Permit TBD
  - Mesa 14-16 Central Gathering Facility (CGF): Construction Permit MD-1425
  - Mesa 15-6 CGF: Construction Permit MD-1424
  - Stewart Point 16-18 CGF: Construction Permit CT-4062A
- **Compressor Stations:**
  - Trail Compressor Station: Construction Permit P0022158
  - Pelican Lake Compressor Station
  - Walker Hollow Compressor Station
  - Flat Rock Compressor Station
  - Knife River Booster Station

Using an optical gas imaging camera, a visual inspection of all equipment and facility piping will be conducted quarterly for sites in the Upper Green River Basin, or compressor stations subject to OOOOa. Applicable well sites will be monitored at least semiannually. The LDAR program overview, inspection protocol, recordkeeping and reporting requirements, and LDAR program maintenance are described in the plan that follows.

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1.0 Program Overview

1.1 Basis

Andeavor applies good operating practices (visual and olfactory detection, use of leak detection solutions [e.g. Snoop], and periodic monitoring with a gas detector) to identify and repair fugitive emissions from equipment leaks on an on-going basis at facilities subject to monitoring fugitive emissions. In order to demonstrate and document the effectiveness of operating procedures that minimize emissions from equipment leaks, Andeavor has implemented a formal Leak Detection and Repair (LDAR) program above and beyond current operating practices. This LDAR program uses an additional monitoring methodology (Optical Gas Imaging) to identify fugitive emissions from equipment leaks. Optical gas imaging (OGI) technology provides a method to qualitatively find gas leaks, however the technology does not provide leak quantifications. The protocol being followed includes the documentation and repair requirements of any leak detected using the OGI technology. Use of this monitoring approach allows Andeavor to demonstrate that its operating practices effectively control fugitive emissions from equipment leaks to insignificant levels.

1.2 Facility Identification

The facilities included in the UGRB LDAR program include the following:

- Pinedale Complex: Operating Permit 3-1-218, Construction Permit P00019707
- Mesa 14-16 Central Gathering Facility (CGF): Construction Permit MD-1425
- Mesa 15-6 CGF: Construction Permit MD-1424
- Stewart Point 16-18 CGF: Construction Permit CT-4062A

The facilities included in the OOOOa LDAR program include the following:

- **Well Sites:**
  - Kinney Unit 13-1 Well Site: Construction Permit P0022497
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  - Trail Unit 54 Pad: Construction Permit TBD
  - Trail Unit 155 Well Site: Construction Permit TBD
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  - Mesa 15-6 CGF: Construction Permit MD-1424
  - Stewart Point 16-18 CGF: Construction Permit CT-4062A
- **Compressor Stations:**
  - Trail Compressor Station: Construction Permit P0022158
  - Pelican Lake Compressor Station
  - Walker Hollow Compressor Station
  - Flat Rock Compressor Station
  - Knife River Booster Station

Modified and newly constructed facilities will be added to Andeavor's LDAR program as applicable.

1.3 Schedule

Andeavor will follow the procedures listed in Section 2.0 "Inspection Protocol" of this plan to monitor the subject facilities according to the requirements specified in Ch. 8, Sec 6 and OOOOa. All facilities will be

inspected quarterly for sites in the Upper Green River Basin, or compressor stations subject to OOOOa with OGI technology. Applicable well sites will be monitored at least semiannually with OGI technology.

1.4 Monitoring Technology

All LDAR inspections will be conducted using OGI instruments. OGI instruments detect the band of light in the electromagnetic spectrum that extends beyond visible light. An OGI camera can identify hydrocarbon vapors which indicate possible sources of fugitive leaks. It should be noted that the intent of this device is solely qualitative; it is unable to quantify the magnitude of a leak (i.e., the leak rate). However, the objective of this program is to identify and repair any observed leak regardless of its magnitude. As such, the camera is the ideal tool to identify these leaks. It should also be noted that all images seen through the OGI instrument are not necessarily methane and volatile organic compound (VOC) emissions.

In addition to allowing for the visual inspection of equipment for fugitive leaks, OGI technology is able to capture images seen and save to an electronic file. During the course of these inspections, all leaks of potential methane or VOC emissions are documented, tagged and tracked until repaired. Documentation of leaks is further discussed in Section 2.4 "Leak Procedure and Documentation."

1.4.1 Infrared Camera Specifications

Andeavor will specifically be utilizing FLIR camera models GF320, GF300 and G300a or equivalent. Per manufacturer certifications (Appendix A), and as required by 60.5397a(c)(7)(i)(A) and (B), this camera is capable of imaging gases in the spectral range for the compound of highest concentration in the potential fugitive emissions, and is capable of imaging gas that is half methane, half propane at a concentration of 10,000 ppm at a flow rate of $\leq$ 60 grams per hour from a quarter inch diameter orifice.

1.5 Overview of Leak Repair Schedule

Andeavor will be diligent about trying to repair every leak in a timely fashion; however, a delayed repair schedule will be required in instances where the facility must be shut down or additional time is required to procure parts or equipment in order to repair a leak. For every leak identified using OGI, the schedule in Table 1-1 below will be followed to repair the leak.

Table 1-1: Leak Repair Schedule

Repair Type	Timing
First Attempt	A first attempt to repair a leak will be made as soon as practicable, but no later than 30 calendar days after initial detection of fugitive emissions per 60.5397a(h)(1).
Delay Repair	If the first attempt is unsuccessful, repair may be delayed for the following reasons: • Parts are unavailable, • Repair of the component poses process safety issues, • The equipment requires shutdown to complete repair, or • Other good cause exists.
Verification of Repair	Within 30 days of initial detection of fugitive emissions, an OGI instrument, soap bubble test, or Method 21 will be used to verify that the leak has been repaired per 60.5397a(h)(3)(i).

Note: Due to a site-specific FEM plan, Trail Compressor Station is subject to 7 day first repair attempt, and 7 day verification of repair instead of the 30 days shown in this table.

Additional information on the leak repair schedule is included in Section 2.4.1 "First Attempt at Repair and Delay of Repair Schedule."

1.6 Components Unsafe or Difficult-to-Monitor

Andeavor operators will prepare an initial list and location of components designated as unsafe- or difficult-to-monitor and an explanation for the designation of these components at each facility. These lists will be reevaluated and updated as needed.

1.6.1 Difficult-to-Monitor Components

As stated in 60.5397a(g)(3), difficult-to-monitor (DTM) components are those that cannot be monitored without elevating the monitoring personnel more than two (2) meters above a supported surface. As stated above, Andeavor will include a location and identification of each fugitive emissions component designated as DTM and an explanation of why it is designated as DTM. A schedule and procedure for monitoring DTM components in contained in Section 2.5 "Monitoring Difficult-to-Monitor Components."

1.6.2 Unsafe-to-Monitor Components

As specified in 60.5397a(g)(4), unsafe-to-monitor (UTM) components are those that cannot be monitored without exposing monitoring personnel to an immediate danger as a consequence of completing the monitoring. Andeavor has categorized components that require additional safety measures to monitor as UTM. As stated above, Andeavor will include a location and identification of each fugitive emissions component designated as UTM and an explanation of why it is designated as UTM. A schedule and procedure for monitoring UTM components are contained in Section 2.6 "Monitoring Unsafe-to-Monitor Components."

2.0 Inspection Protocol

2.1 Sensitivity Check

An OGI sensitivity check will be performed each day before camera use. Prior to beginning any leak monitoring work, the OGI instrument will be tested at the mass flow rate determined in Section 2.1.1 "Mass Flow Rate Calculations" for each camera configuration used during monitoring (different lenses used, etc.). A "Sensitivity Check" form will be completed during each daily sensitivity check (Appendix B).

A daily sensitivity check will consist of the following:

1. Start the OGI instrument according to the manufacturer's instructions. Start with the camera in AUTO mode.
2. Use methane of at least 98% purity for the sensitivity check.
3. Apply a flow meter in Liters (1-5 Liter per minute) to the regulator on the methane cylinder.
4. Set up the OGI camera at a maximum distance desired for the inspections, approximately 10 feet from the outlet of the flow meter (greater distances may also be used if an image is visible).
5. Use an emission rate of 60 grams per hour for the sensitivity check. The flow rate will be determined at the time of the leak check according to the equation illustrated below in Section 2.1.1. Determine a new flow rate if another gas concentration is used.
6. Open the valve on the flow meter to the calculated flow rate while observing and recording the gas flow image on the camera. If the gas flow image is not confirmed, the observer is to move closer to the gas source until an image is observed.
7. Measure the distance from the OGI camera to the gas source. This distance is the maximum distance for imaging during the day's monitoring. This distance will be measured or estimated as is feasible.
8. Document the sensitivity check with the sensitivity check form; recording date, inspector, gas used, flow rate, distance, camera serial number, lens size, camera thermal tuning settings (Auto or Manual and integration setting), wind speed, temperature, any other notes required.

2.1.1 Mass Flow Rate Calculations

To determine the required flow rate for methane gas:

a) first calculate what the density of methane gas is in grams per liter:

$$\frac{0.668\ kg}{m^3} \times \frac{1000\ g}{kg} \times \frac{m^3}{1000\ liter} = \frac{0.668\ g}{liter}$$

b) next calculate the minimum leak detection level in grams per minute:

$$\frac{60g}{hr} \times \frac{hr}{60\ min} = \frac{1\ g}{min}$$

c) now calculate the required flow rate using both steps a) and b):

$$\frac{1\ g}{min} \times \frac{liter}{0.668\ g} = \frac{1.5\ liters}{min}$$

d) the last step is to adjust the required flow rate according to actual temperature and pressure:

$$V_a = \frac{P_s \times V_s \times (459.67 + T_a)}{P_a \times (459.67 + T_s)}$$

where:

Va = required flow rate for actual conditions (L/min)
Pa = actual pressure (psia)
Ta = actual temperature (F°)
Ps = standard pressure (psia)
Ts = standard temperature (F°)
Vs = required flow rate at standard conditions (L/min)

2.2 On-Site Procedure

Using an OGI camera, a visual inspection will be performed on all components that have the potential to emit fugitive emissions of methane or VOC, including but not limited to valves, connectors, pressure relief devices, open-ended lines, flanges, covers and closed vent systems not subject to §60.5411a, thief hatches or other openings on a controlled storage vessel not subject to §60.5395a, compressors, instruments, and meters. A defined observation path and sitemap will be created for each site subject to OOOOa to ensure all fugitive emission components are within sight of the path. Operators will follow the defined observation path during monitoring unless weather considerations or other interferences require a different path to be used. Operators will ensure any deviations from the defined observation path will still include monitoring within the maximum imaging distance calculated during the daily sensitivity check.

2.2.1 Weather-Related Operational Considerations

OGI instruments can be adjusted to account for relative humidity of the air between the camera and the material being observed. If actual relative humidity is unable to be measured, it will be set to 50%. The OGI camera should not be used during periods of rain due to possible water damage to the sensitive electronic components. The camera's ability to detect emissions during snow storms and extreme cold is greatly degraded, and therefore monitoring should not be conducted during such conditions. If wind conditions exceed 20 miles per hour, or other adverse conditions require it, the operator will postpone monitoring until later in the day, or will reschedule depending on weather conditions. Based on their training, operators will use their best judgment to determine if there is adequate thermal background to proceed with the monitoring, and will postpone or reschedule as necessary.

2.3 Facility Inspection Form

Each facility inspection will be documented using the "Field Surveillance Form" (Appendix B). The records and documentation associated with the OGI monitoring inspections performed will include the following, in accordance with 60.5420a(c)(15):

1. Date of the survey.
2. Beginning and end time of the survey.
3. Name of operator(s) performing survey. The training and experience of the operator will also be included.
4. Monitoring instrument used.
5. Reference to one or more digital photographs or videos, captured from the optical gas imaging instrument used during the monitoring, of each required monitoring survey being performed. The digital photograph will include the date the photograph was taken and the latitude and longitude of the

collection of fugitive emissions components at the facility imbedded within or stored with the digital file. If imbedded latitude and longitude is not feasible, the digital photograph or video will consist of an image of the monitoring survey being performed with a separately operating GPS device within the same digital picture or video, provided the longitude and latitude output of the GPS unit can be clearly read in the digital image.

6. Ambient temperature, sky conditions, and maximum wind speed at the time of the survey.
7. Any deviations from the monitoring plan or a statement that there were no deviations from the monitoring plan.
8. Documentation of each fugitive emission, including the following information:
    a. Location.
    b. Number and type of components for which fugitive emissions were detected
    c. Number and type of DTM and UTM fugitive emission components monitored.
    d. Number and type of fugitive emissions components that were not repaired.
    e. Number and type of components that were tagged as a result of not being repaired during the monitoring survey when the fugitive emissions were initially found
    f. Repair methods applied in each attempt to repair the fugitive emissions components.
    g. Number and type of fugitive emission components placed on delay of repair and explanation for each delay of repair.
    h. The date of successful repair of the fugitive emissions component.
    i. Instrumentation used to resurvey a repaired fugitive emissions component that could not be repaired during the initial fugitive emissions finding.
    j. Any deviations from the monitoring plan or a statement that there were no deviations from the monitoring plan

Records of numbers 1 – 7 and 8(a) – 8(h) above will be included on the "Field Inspection Form." Records of 8(a) – 8(j) will be included on the "Leak Repair Tracking Form" for leaks unable to be fixed during initial inspection, also included in Appendix B.

2.4 Leak Procedure and Documentation

If the OGI equipment indicates a leak, the leak will be documented on the "Field Surveillance Form." The operator will note if a first attempt to repair the leak was able to be made. If a first attempt was able to be made, the operator will note if the repair attempt was successful. If a first attempt to repair was unable to be performed, or the leaking component is unable to be repaired during initial monitoring, the equipment will be tagged on the leak. Tags will be weather-resistant, sequentially numbered, and tag numbers will be noted on the "Field Surveillance Form." A digital photograph of the location of the leak may be taken to assist field personnel in identifying leaking components unable to be immediately repaired. Per OOOOa, operators will be notified of tagged leaks and have 30 days from initial fugitive emission detection to make a final repair and verify leak repair. (Note: For Trail Compressor Station, operators will have 7 days to repair and verify the repair due to the site specific FEM plan).

Some pieces of equipment found at these facilities vent by design, and are not fugitive emissions components. Pneumatically actuated devices such as liquid level controllers and pressure controllers use field supplied natural gas and depending on their design, may continuously emit or emit as they are actuated. The images associated with these sources are considered on a case-by-case basis to determine if the emissions are significantly above 'normal' operating conditions.

2.4.1 First Attempt at Repair and Delay of Repair Schedule

As stated above, operators will have 30 days (7 days for Trail Compressor Station) from initial fugitive emission detection to make the first attempt at repairing the leaking component. This will consist of typical basic repairs (i.e., tightening packing, tightening tubing ferrules). If it is determined that a first attempt to repair a leak is unable to be performed because of the reasons noted below, the component will be placed on the delay of repair list.

- Parts are unavailable (technically infeasible)
  - If parts are unavailable, they must be ordered promptly and the repair must be made within sixty (60) working days of receipt of the parts if a shutdown doesn't occur sooner.
- The equipment requires shutdown to complete repair
  - If shutdown is required, the leak must be repaired during the next scheduled compressor station shutdown, well shutdown, well shut-in, or within two years, whichever is earlier.
- Other good cause exists (technically infeasible)
  - If delay is attributable to other good cause (safety, etc.), repairs must be completed within sixty (60) working days after the cause of delay ceases to exist.

2.4.2 Leak Repair Verification and Documentation

Once a fugitive emission leak is initially detected, the operator will have 30 days to make a first attempt at repair, repair a tagged component (if applicable), and resurvey the component to verify leak repair. Operators may use OGI, the soap bubble test, or Method 21 to verify leak repair. The leak tag may only be removed once repair of the leak has been verified. A fugitive emissions component is repaired when the optical gas imaging instrument shows no indication of visible emissions.

Repair forms will be filled out following a repair attempt, and will be completed following the resurvey of the leak. The "Leak Repair Tracking Form" will include the following:

1. Facility name
2. Person performing repair
3. Date leak was reported
4. Description of leak and associated tag number
5. Description of repair
6. Date of repair
7. Method used to verify repair of leak
8. Reason for delay if repair needs to be placed on the delay of repair list

2.4.3 Leak Tracking Procedure

Following the inspection, a spreadsheet will be prepared detailing the location information, inspection date, leaks detected, and the associated tag numbers. Following leak repairs and verification, the same spreadsheet will be updated to include the date of repair to close out each leak.

2.5 Monitoring Difficult-to-Monitor Components

In accordance with 60.5397a(g)(3)(i), Andeavor has developed a protocol for monitoring DTM fugitive emissions components at least once per year. Beginning in 2017, scaffolding and/or man lifts will be scheduled annually at each facility and will allow the operator to monitor components greater than two meters above ground or platforms. DTM monitoring may or may not coincide with the regular quarterly or semiannual site evaluations. The repair protocol will be the same for DTM components as described in Section 2.4 and

Sections 2.4.1 – 2.4.3. If leaks are found, each will be documented on the "Field Surveillance Form," and the operator will note that the leaking component has been identified as a DTM component. DTM components unable to be repaired upon initial fugitive emission leak detection will be tagged, if feasible, and documented on both the "Field Surveillance Form" and the "Leak Repair Tracking Form."

2.6 Monitoring Unsafe-to-Monitor Components

In accordance with 60.5397a(g)(4)(i), Andeavor has developed a protocol for monitoring UTM fugitive emissions components at least once per year. Andeavor will monitor all safely accessible UTM components annually, beginning in 2017. Safely accessible components are those that may require a confined space entry permit but do not include components that would require disconnecting or taking equipment offline, or other significant safety concerns. If leaks are found, each will be documented on the "Field Surveillance Form," and the operator will note that the leaking component has been identified as a UTM component. UTM components unable to be repaired upon initial fugitive emission leak detection will be tagged, if feasible, and documented on both the "Field Surveillance Form" and the "Leak Repair Tracking Form." Once the leak repair has been verified, the operator will restore the equipment and equipment surroundings as they were before the repair attempt(s) were made.

3.0 Recordkeeping and Reporting

Scanned copies of "Field Surveillance Forms," "Leak Repair Tracking Forms," "Sensitivity Check" forms, electronic files containing OGI pictures, and calibration gas certifications for gas used to perform sensitivity checks will be maintained by Andeavor for a period of five (5) years and will be made available upon request.

Though not required in Ch. 8, Sec 6, this section has been included per OOOOa. Facilities subject to OOOOa will submit annual reports for each collection of fugitive emissions components at a well site and each collection of fugitive emissions at a compressor station.

Each OOOOa monitoring report will be submitted to the Administration annually and include the following information in accordance with 60.5397a(j):

1. Date of the survey.
2. Beginning and end time of the survey.
3. Name of operator(s) performing survey. The training and experience of the operator will also be included.
4. Ambient temperature, sky conditions, and maximum wind speed at the time of the survey.
5. Monitoring instrument used.
6. Any deviations from the monitoring plan or a statement that there were no deviations from the monitoring plan.
7. Number and type of components for which fugitive emissions were detected
8. Number and type of fugitive emissions components that were not repaired.
9. Number and type of DTM and UTM fugitive emission components monitored.
10. Number and type of fugitive emission components placed on delay of repair and explanation for each delay of repair.
11. The date of successful repair of the fugitive emissions component.
12. Instrumentation used to resurvey a repaired fugitive emissions component that could not be repaired during the initial fugitive emissions finding.

4.0 LDAR Program Maintenance

4.1 Operator Training

Any Andeavor staff member who has received the training specified below may use the OGI instrument. Additionally, the camera may be used by contractors and consultants who have obtained appropriate training, and have been authorized by Andeavor facility management to conduct monitoring.

4.1.1 Necessary Training

One of the following trainings must be satisfactorily completed before using the OGI camera:

1. Certified Level I Infrared Thermography or optical gas imaging course from OGI camera manufacturer. At least one Andeavor camera operator shall receive this level of training.
    a. The Level I Infrared Thermography training course is geared to the new OGI camera user and focuses on the camera's use for a variety of condition monitoring/predictive maintenance applications. Attendees who complete all training course requirements and a thermography assignment receive a Level I Infrared Thermography certification, or
2. Training developed on a site-specific basis by experienced and proficient users.

4.1.2 Site-Specific Operator Certifications

After successfully completing one of the trainings described in Section 4.1.1, an operator shall be certified to use OGI within an Andeavor facility. This person shall also be qualified to provide on-site training to others who receive on-the-job instruction for operating an IR camera at a specific facility.

Camera operators that receive on-the-job training provided by a certified OGI operator shall be considered certified to use the camera after:

1. Receiving one work shift of training comprised of an overview of camera operation, followed by at least four hours of field training, and
2. One additional field-check in which the trainee and a certified camera operator conduct side-by-side observations of operating equipment that has the potential for observable emissions.

All documentation of training (both from an OGI camera manufacturer and on-the-job training provided on a site-specific basis) shall be retained in the employee's training file for the duration of employment at the Andeavor facility.

4.2 Calibration and Maintenance Procedures

At a minimum, Andeavor calibration and maintenance procedures will comply with those recommended by the manufacturer. The text below does not replace procedures described in the manufacturer-supplied operating manual for the OGI instrument.

4.2.1 Calibration Procedure

In general, calibration of an OGI camera is not conducted by the user. The camera must be returned to the manufacturer for this specialized service. The LDAR Coordinator of these facilities is responsible for ensuring that all necessary preventative maintenance that is recommended by the camera manufacturer is completed on schedule. A scanned copy of the calibration gas certification will be maintained in the electronic records.

4.2.2 Maintenance Procedure

The OGI camera and lens must be kept clean and free of debris or residue. The camera body can generally be cleaned using a lint-free cloth dampened with a solution of water and a weak detergent. The infrared lens may be cleaned with cotton wool dampened with a commercial lens cleaning fluid consisting of at least 30% isopropyl alcohol. Alternatively, these fluids can also be used for this purpose: 96% ethyl alcohol, dimethyl ether, or a mixture of 50% acetone and 50% ethyl alcohol. Care will be taken when cleaning the lens to avoid damaging the anti-reflective coating.

Most OGI instruments contain a micro-cooler containing pressurized helium gas. The micro-cooler is designed to provide thousands of hours of operation, but over time the helium pressure will decrease. Additionally, the micro ball bearings in the cooler motor will wear over time and require replacement. As these mechanical elements continue to degrade, the camera must be returned to the manufacturer for service. The user can judge whether these conditions exist by:

1. Noting the amount of time that the cooler runs at a maximum speed before decreasing to approximately 40% of its maximum. As the helium pressure decreases, the cooler motor runs longer/ when this exceeds the normal duration by approximately 50% the camera manufacturer should be consulted.
2. Micro-ball bearing wear will be manifested by the motor becoming louder. If bearing wear is suspected due to noisier operation, the camera should be returned to the manufacturer for inspection.

APPENDIX A – OGI Manufacturer Certifications

EPA 0000a CERTIFIED

INDEPENDENT TESTING DEEMS FLIR CAMERAS COMPLIANT

FLIR is proud to announce its GF320, GF300, and G300a cameras have been independently tested and deemed compliant with the EPA's NSPS 40 CFR part 60, subpart 0000a sensitivity standard for optical gas imaging equipment.

Testing was performed by the National Physical Laboratory (NPL), which confirmed the FLIR GF320, GF300, and G300a optical gas imaging cameras are capable of imaging a gas that is half methane, half propane at a concentration of 10,000 ppm at a flow rate of ≤60g/hr from a quarter inch diameter orifice.

Note: GF320, GF300, and G300a cameras have identical detectors, hydrocarbon filters, optical platforms, and HSM algorithms.

CALIBRATION REQUIREMENTS

Gas Detection: No Calibration Required

The GF320, GF300, and G300a camera's ability to detect gases is not influenced by any calibration process and will not degrade over time.

GAS COMPOUND DETECTION

The GF320, GF300, and G300a optical gas imaging cameras are capable of imaging a wide array of gas compounds, but were specifically designed to see the following hydrocarbons*:

Methane	Isoprene
Benzene	MEK
Propane	Methanol
Butane	MIBK
Ethane	Octane
Ethanol	Pentane
Ethylbenzene	Propylene
Ethylene	Toluene
Heptane	Xylene
Hexane	1-Pentene

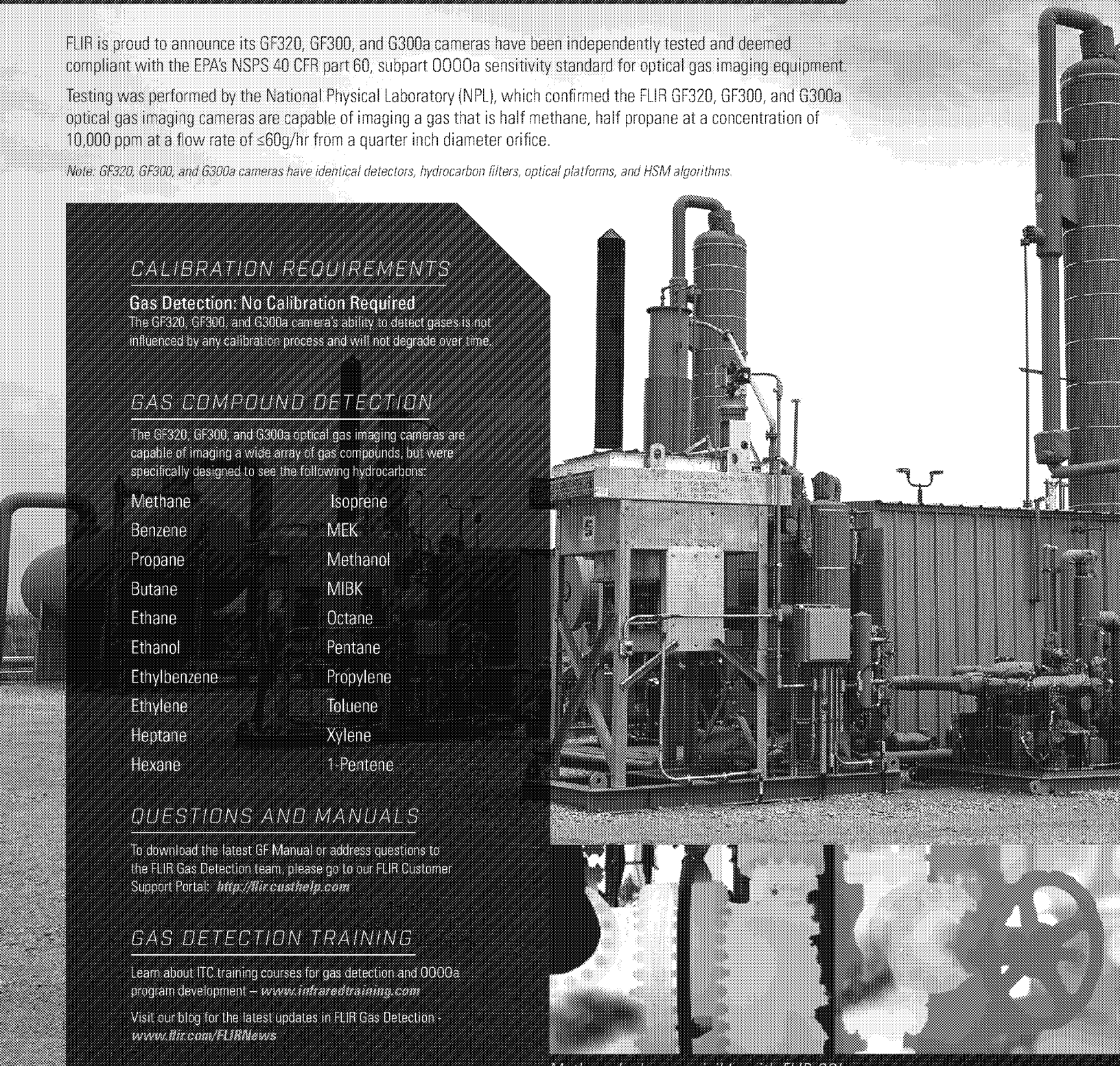
QUESTIONS AND MANUALS

To download the latest GF Manual or address questions to the FLIR Gas Detection team, please go to our FLIR Customer Support Portal: ***http://flir.custhelp.com***

GAS DETECTION TRAINING

Learn about ITC training courses for gas detection and 0000a program development – ***www.infraredtraining.com***

Visit our blog for the latest updates in FLIR Gas Detection - ***www.flir.com/FLIRNews***



Methane leaks now visible with FLIR OGI cameras

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APPENDIX B – LDAR Inspection Forms

DAILY CAMERA SENSITIVITY CHECK FORM

TESORO LOGISTICS
Tesoro Logistics, LP - Rockies

Date & Time: _____ Camera Make & Model: _____

Camera Serial #: _____Camera Lens & Filter: _____

Temperature: _____(deg.F) Wind Speed: _____(mph) Cloud Cover: _____

Calculate Required Flow Rate for Actual Conditions:

$$V_a = \frac{P_s * V_s * (459.67+T_a)}{P_a * (459.67+T_s)}$$

Example
Actual Temperature: 50 F
Actual Pressure: 12 psia

Required Flow Rate: **1.8** L/min

Where

- P_a = actual pressure (psia)
- T_a = actual temperature (deg. F)
- V_a = required flow rate for actual conditions (liters per minute)
- P_s = standard pressure (14.7 psia)
- T_s = standard temperature (deg. F)
- V_s = required flow rate at standard conditions (1.5 liters per minute)[1]

Calculated flow rate (L/min): _____ Camera Thermal tuning settings: _____

Natural Gas Emission Source Observed:_____ Distance from Emission Source: _____

Gas Cylinder ID #: _____ Cylinder Contents: _____ (must be methane)

Cylinder Gas Concentration (%): _____ (must contain 98% or greater methane gas)

_____ _____

Name of Observer (Print) Signature

Notes:
[1] Refer to QEPM Gathering I, LLC Leak Detection and Repair Protocol text for derivation of required flow rate.

TESORO LOGISTICS

INFRARED CAMERA
FIELD SURVEILLANCE FORM

Company: Tesoro Logistics - Rockies ________ Facility Name: ____________________

Lat: ____________________ Long: ____________________ Is the facility in operation? Yes ☐ No ☐

Name of Person(s) Performing Inspection: ____________________

Training and Experience of Inspector: ☐Completed Certified Level I Infrared Thermography of OGI course ☐ Received on-site training from certified employee

Date of Surveillance: ____________	Start Time: ____________	End Time: ____________
Temperature: ____________	Max Wind Speed: ____________	Cloud Cover: ____________
Camera Model and Serial #: ____________	Pic/Video ID Range (Need at least 1 pic during survey): ____________	
Any deviations from the monitoring plan: ____________		

Leak Tag ID	**Equipment Type**	**Leak Description (include component description, and if DTM or UTM)**	**Picture/Video ID** (if applicable)	**Detection Method**	**First Repair Attempted?**	**Repair Attempt Successful?**
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ____________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ____________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ____________	Yes ☐ No ☐[2]

(1) If first repair is not attempted immediately, a physical numbered tag must be attached to the leaking component, and the LDAR Leak Repair Tracking form must be completed. First repair must be attempted within 30 days of leak identification.
(2) If repair attempt is not successful a physical numbered tag must be attached to the leaking component and the LDAR Leak Repair Tracking form must be completed.

TESORO LOGISTICS

INFRARED CAMERA
FIELD SURVEILLANCE FORM

Facial Name: ______________________ Date of Surveillance: ______________________

Leak Tag ID	Equipment Type	Leak Description (include component description, and if DTM or UTM)	Video ID	Detection Method	First Repair Attempted?	Repair Attempt Successful?
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]
	☐ Tank ☐ Separator ☐ Dehy Unit ☐ Pneumatic Pump ☐ Combustor ☐ Other (Describe)		Leak Pic/Video ID: Repaired Pic/Video ID:	IR Camera ☐ Audio *(hear)* ☐ Visual *(seen)* ☐ Olfactory *(odor)* ☐	Yes ☐ No ☐[1] Repair Method: ______________	Yes ☐ No ☐[2]

[1] *If first repair is not attempted immediately, a physical numbered tag must be attached to the leaking component, and the LDAR Leak Repair Tracking form must be completed. First repair must be attempted within 10 days of leak identification.*
[2] *If repair attempt is not successful a physical numbered tag must be attached to the leaking component and the LDAR Leak Repair Tracking form must be completed.*

TESORO LOGISTICS

LDAR Leak Repair Tracking Form

(Complete for leaks not repaired at the time of discovery)

Facility Name:

Person who Discovered Leak:	Date Leak Discovered:	Tag Number:

Description of Leak (include if DTM or UTM):

Description of Repair:

Date of Repair:	Date of Repair Verification:	Pic/Video ID:

Instrument used to resurvey:	Deviations from monitoring plan?

Further Repair Required? Yes ☐ No ☐	Is this Repair Complete? Yes ☐ No ☐

Reason for Delayed Repair:

- ☐ Parts are unavailable[1] Date parts ordered: _____
- ☐ Equipment requires shutdown to complete repair[2]
- ☐ Other good cause exists[3] Explain good cause: _____

[1] *If parts are unavailable, they must be ordered promptly and the repair must be made within thirty (30) working days of receipt of the parts.*
[2] *If shutdown is required; the leak must be repaired during the next scheduled shutdown.*
[3] *If delay is attributable to other good cause; repairs must be completed within thirty (30) working days after the cause of delay ceases to exist.*

Person Performing Repair:	Initials:	Date:
Name of Supervisor:	Initials:	Date:

**First attempt at repair must be completed within 30 days of leak identification.*
**Leak verification inspection must be completed within 30 days of repair.*

TESORO LOGISTICS

LDAR Leak Repair Tracking Form

(Complete for leaks not repaired at the time of discovery)

Facility Name:

Person who Discovered Leak:	Date Leak Discovered:	Tag Number:

Description of Leak (include if DTM or UTM):

Description of Repair:

Date of Repair:	Date of Repair Verification:	Pic/Video ID:

Instrument used to resurvey:	Deviations from monitoring plan?

Further Repair Required? Yes ☐ No ☐	Is this Repair Complete? Yes ☐ No ☐

Reason for Delayed Repair:

- ☐ Parts are unavailable[1] Date parts ordered: _____
- ☐ Equipment requires shutdown to complete repair[2]
- ☐ Other good cause exists[3] Explain good cause: _____

[1] If parts are unavailable, they must be ordered promptly and the repair must be made within thirty (30) working days of receipt of the parts.
[2] If shutdown is required; the leak must be repaired during the next scheduled shutdown.
[3] If delay is attributable to other good cause; repairs must be completed within thirty (30) working days after the cause of delay ceases to exist.

Person Performing Repair:	Initials:	Date:
Name of Supervisor:	Initials:	Date:

**First attempt at repair must be completed within 30 days of leak identification.*
**Leak verification inspection must be completed within 30 days of repair.*

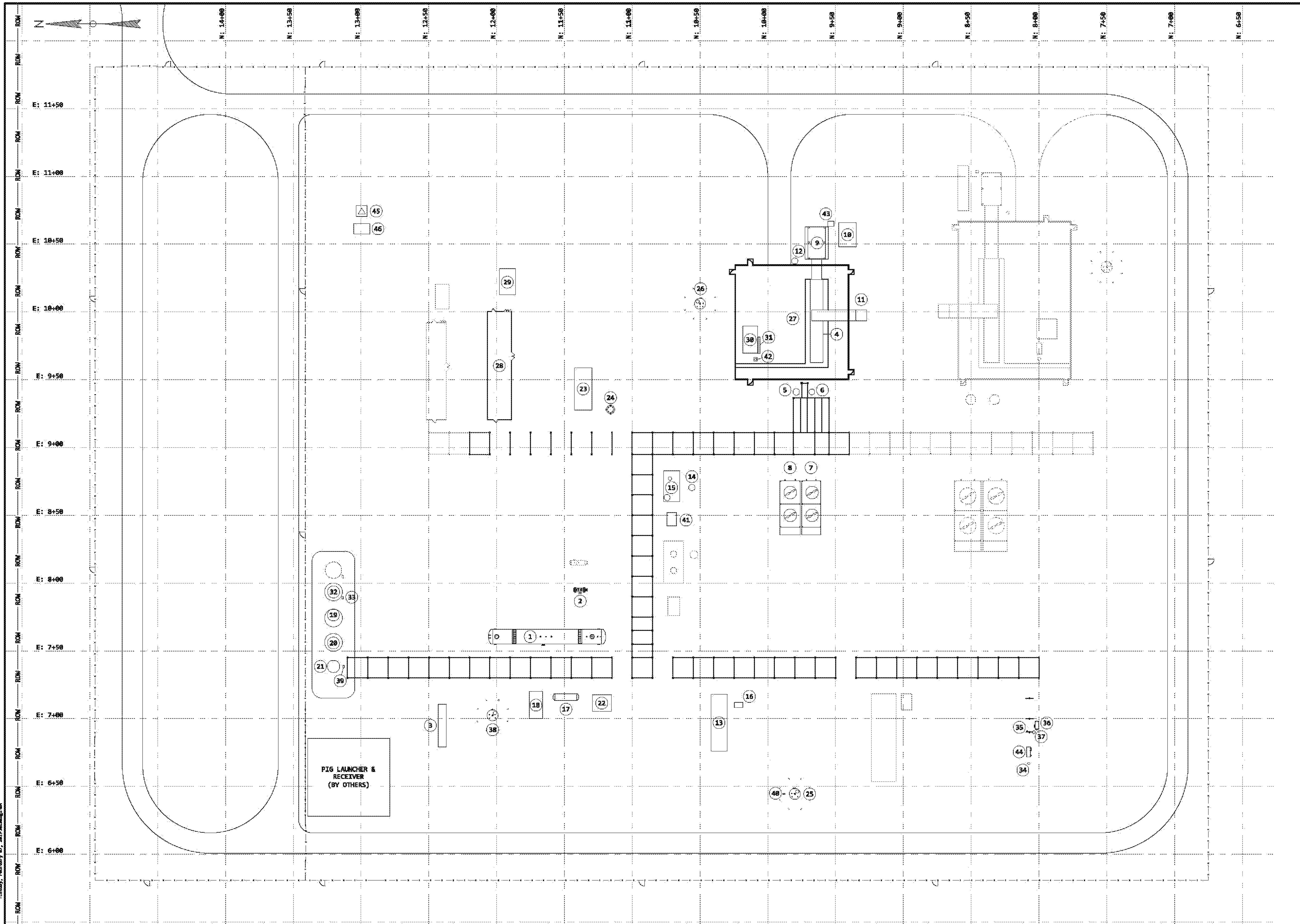
Andeavor Logistics

LEAK DETECTION AND REPAIR PROTOCOL

Site-Specific Information

- Site Map [40 CFR §60.5397a(d)(1)]
- Observation Path [40 CFR §60.5397a(d)(2)]

Walker Hollow Compressor Station



EQUIPMENT LIST

ITEM	TAG	DESCRIPTION
1	V-101	SLUG CATCHER
2	F-101	INLET FILTER SEPARATOR
3	SK-106	DISCHARGE GAS METER
4	C-101/C-102	FIELD COMPRESSORS
5	V-102	1ST STAGE SUCTION SCRUBBER
6	V-103	2ND STAGE SUCTION SCRUBBER
7	AC-101	1ST STAGE DISCHARGE COOLER
8	AC-102	2ND STAGE DISCHARGE COOLER
9	EAC-101	TURBINE EVAP. AIR COOLER
10	AC-105	LUBE OIL COOLER
11	-	TURBINE EXHAUST SILENCER
12	-	DEMISTER
13	SK-102	TEG REGENERATION SKID
14	T-101	TEG CONTACTOR
15	SK-101	WET GAS SCRUBBER & DRY GAS FILTER COALESCER SKID
16	AC-104	BTEX CONDENSER
17	V-105	3-PHASE PIG SEPARATOR
18	SK-104	CONDENSATE PUMP AROUND SKID
19	TK-101	PRODUCED WATER TANK
20	TK-102	PRODUCED WATER TANK
21	TK-103	TEG STORAGE TANK
22	C-103/C-104	FLASH GAS COMPRESSORS
23	C-105/C-106	INSTRUMENT AIR BUILDING
24	V-119	INSTRUMENT AIR RECEIVERS
25	TK-105	TEG SUMP
26	TK-107	COMPRESSOR BUILDING SUMP
27	-	COMPRESSOR BUILDING
28	-	PDC BUILDING
29	-	TRANSFORMER
30	SK-103	FUEL GAS CONDITIONING SKID
31	SK-107	FUEL GAS METER
32	TK-104	EVAP. WATER TANK
33	P-112	EVAP. WATER MAKEUP PUMP
34	FL-101	BTEX SCRUBBER OVHD FLARE
35	-	EMERGENCY VENT STACK
36	V-117	FLARE KO
37	P-109	FLARE KO PUMP
38	TK-106	COND. PUMP SKID SUMP
39	P-110	TEG MAKEUP PUMP
40	P-111	TEG SUMP PUMP
41	AC-103	LEAN TEG COOLER
42	F-111	FUEL GAS FILTER/COALESCER
43	P-115	EVAP. WATER PUMP
44	SK-105	FLARE SKID
45	-	COMMUNICATIONS TOWER (BY OTHERS)
46	-	COMMUNICATIONS BUILDING (BY OTHERS)

ISSUED FOR CONSTRUCTION

EXTERNAL REFERENCES	EXTERNAL REFERENCES	REFERENCE SHEET NO.	REFERENCE SHEET NO.	REFERENCE SHEET NO.	REV	STATUS	DESCRIPTION	DATE	BY	CHK	ENG	MGR
-	-	-	-	-	0	IFC	ISSUED FOR CONSTRUCTION	11/20/2015	JMK	FEL	SJC	DWM
-	-	-	-	-	1	IFC	RE-ISSUED FOR CONSTRUCTION	2/19/2016	JMK	DJA	SJC	DWM
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

SCALE: 1"=35'-0"

DATE CREATED: 10/1/2015

TESORO LOGISTICS

PLANT: WALKER HOLLOW COMPRESSOR STATION

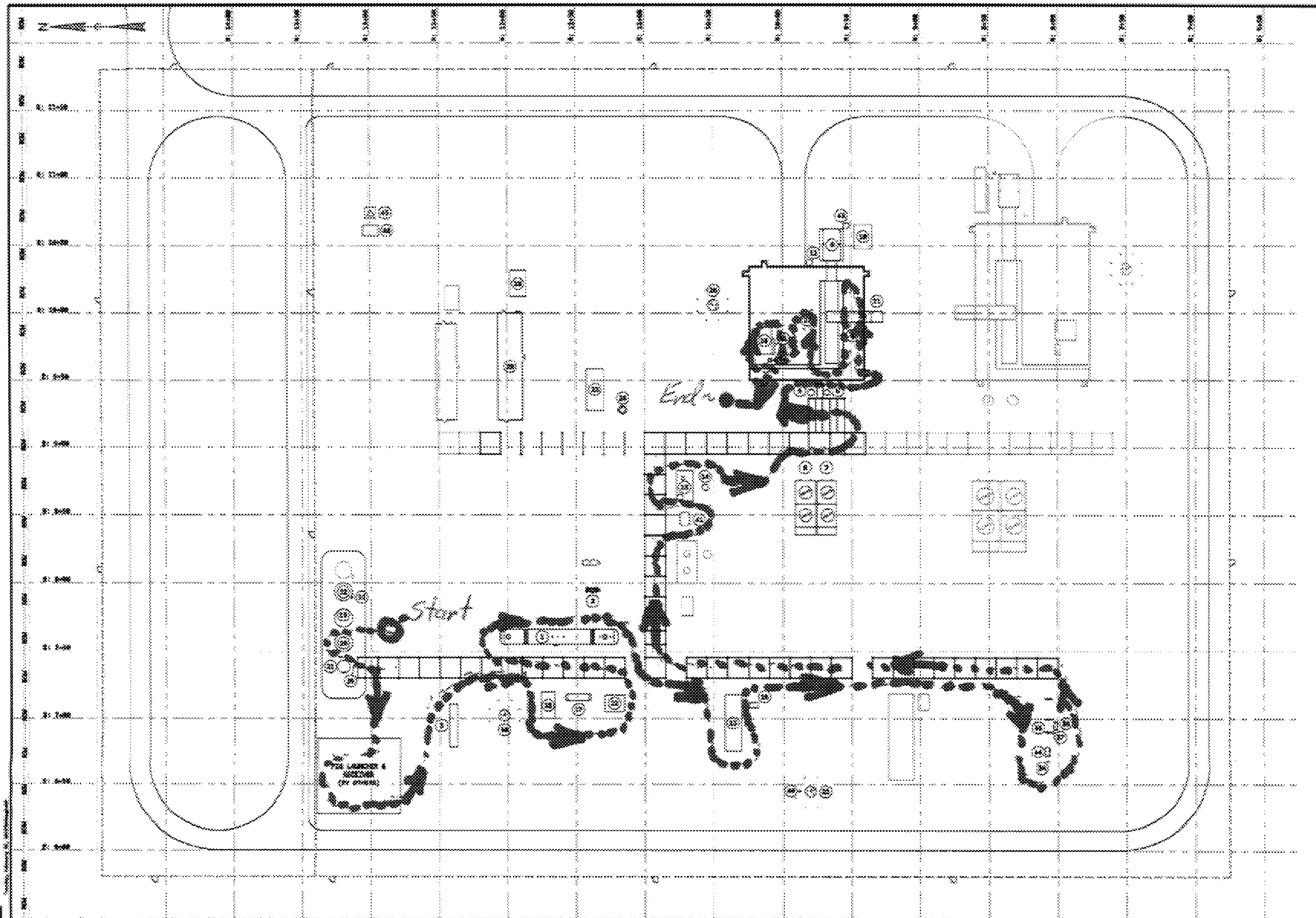
LOCATION: UINTAH COUNTY, UT

PLOT PLAN

-

TLR-WHCS-PLP-0001

REVISION 1



EQUIPMENT LIST

ITEM	TAG	DESCRIPTION
1	[illegible]	SLUG CATCHER
2	[illegible]	INLET FILTER SEPARATOR
3	[illegible]	DISCHARGE GAS METER
4	[illegible]	FIELD COMPRESSORS
5	[illegible]	1ST STAGE SUCTION SCRUBBER
6	[illegible]	2ND STAGE SUCTION SCRUBBER
7	[illegible]	1ST STAGE DISCHARGE COOLER
8	[illegible]	2ND STAGE DISCHARGE COOLER
9	[illegible]	TURBINE EVAP. AIR COOLER
10	[illegible]	LUBE OIL COOLER
11	-	TURBINE EXHAUST SILENCER
12	-	[illegible]
13	[illegible]	TEG REGENERATION SKID
14	[illegible]	TEG CONTACTOR
15	[illegible]	WET GAS SCRUBBER & DRY GAS FILTER COALESCER SKID
16	[illegible]	STILL CONDENSER
17	[illegible]	3-PHASE [illegible] SEPARATOR
18	[illegible]	CONDENSATE PUMP AROUND SKID
19	[illegible]	PRODUCED WATER TANK
20	[illegible]	PRODUCED WATER TANK
21	[illegible]	TEG STORAGE TANK
22	[illegible]	FLASH GAS COMPRESSORS
23	[illegible]	INSTRUMENT AIR BUILDING
24	[illegible]	INSTRUMENT AIR RECEIVERS
25	[illegible]	TEG SUMP
26	[illegible]	COMPRESSOR BUILDING SUMP
27	-	COMPRESSOR BUILDING
28	-	MCC BUILDING
29	-	TRANSFORMER
30	[illegible]	FUEL GAS CONDITIONING SKID
31	[illegible]	FUEL GAS METER
32	[illegible]	EVAP. WATER TANK
33	[illegible]	EVAP. WATER MAKEUP PUMP
34	[illegible]	[illegible]
35	-	EMERGENCY VENT STACK
36	[illegible]	FLARE KO
37	[illegible]	FLARE KO PUMP
38	[illegible]	COMP. PUMP SKID SUMP
39	[illegible]	TEG MAKEUP PUMP
40	[illegible]	TEG SUMP PUMP
41	[illegible]	LEAN TEG COOLER
42	[illegible]	FUEL GAS FILTER/COALESCER
43	[illegible]	EVAP. WATER PUMP
44	[illegible]	FLARE SKID
45	-	COMMUNICATIONS TOWER (BY OTHERS)
46	-	COMMUNICATIONS BUILDING (BY OTHERS)

ISSUED FOR CONSTRUCTION

REV	STATUS	DESCRIPTION
0	IFC	ISSUED FOR CONSTRUCTION
1	IFC	RE-ISSUED FOR CONSTRUCTION

TESORO LOGISTICS

COPY

PLOT PLAN